# From Artificial Intelligence to Explainable Artificial Intelligence in Industry 4.0: A Survey on What, How, and Where

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## Abstract

Nowadays, Industry 4.0 can be considered a reality, a paradigm integrating modern technologies and innovations. Artificial intelligence (AI) can be considered the leading component of the industrial transformation enabling intelligent machines to execute tasks autonomously such as self-monitoring, interpretation, diagnosis, and analysis. AI-based methodologies (especially machine learning and deep learning support manufacturers and industries in predicting their maintenance needs and reducing downtime. Explainable artificial intelligence (XAI) studies and designs approaches, algorithms and tools producing human-understandable explanations of AI-based systems information and decisions. This article presents a comprehensive survey of AI and XAI-based methods adopted in the Industry 4.0 scenario. First, we briefly discuss different technologies enabling Industry 4.0. Then, we present an in-depth investigation of the main methods used in the literature: we also provide the details of what, how, why, and where these methods have been applied for Industry 4.0. Furthermore, we illustrate the opportunities and challenges that elicit future research directions toward responsible or human-centric AI and XAI systems, essential for adopting high-stakes industry applications.